The Use of Gene Therapy in Mice to Reverse the Effects of Type One Diabetes

**Abstract**

 Diabetes is a problem that many people all over the world are battling every day. Many of the people who have diabetes have type two diabetes. Type two diabetes usually occurs in people who are overweight, meaning their bodies still produce insulin, but their bodies cannot keep and make enough insulin to keep their blood glucose levels at a proper level. On the other hand, type one diabetes is an autoimmune disease meaning the bodies T-Cells attack insulin cells produced by the pancreas, which leaves the body with no insulin production. For many years scientists have performed studies on how to cure type one diabetes. There have been multiple studies on how a type one diabetic patient can receive a new pancreas, sometimes this can reverse the effects of diabetes, but this is not a readily available procedure that many people have access too. Although a cure has not yet been found, in the past few years there have been many great advances and steps toward finding a cure. The recent studies that have been performed in the field of diabetes have been performed on mice, where now, gene therapy is the main focus of many experiments. Many experiments have concluded that gene therapy in mice can reverse the effects of type one diabetes. Many of the studies conducted did not publish their results until they knew the effects of the gene therapy and if it would last for a long period of time. Many of the studies performed on mice showed that the gene therapy still reversed the effects of type one diabetes a whole year later. The question many scientists face is whether or not this gene therapy will have a lasting impact on the reversal of type one diabetes or if the gene therapy done on the mice will cause different problems elsewhere in the body.

**Introduction**

 Diabetes is a chronic disease where people that have this disease have limited or no insulin production from the pancreas. For years people with diabetes have used a form of exogenous insulin, which is provided by the form of multiple daily injections or the form of insulin pump. The question many people and scientists ponder is whether there is a possible cure for diabetes or a way to make human bodies to regenerate insulin cells. Type one diabetes in particular is an autoimmune disease, in which the bodies’ T-cells recognize insulin cells as foreign invaders and destroy these cells and leave the body with no insulin. The new way scientists are trying to reverse the effects of diabetes is performing gene therapy in mice. There are many different approaches to gene therapy when it comes to diabetes, and scientists have been sure to examine as many different ways as possible. In the study that is being closely examined, the scientists were interested in whether insulin could somehow be produced outside of the pancreas, in which the insulin was being produced by the liver. The scientists in this study were also interested in seeing if adding a virus in with this cDNA would help the production of insulin to stay constant.

**Recent Progress**

 Most of the gene therapy studies that have been performed have included an adenovirus vector. To explain further what this is and its importance, it is important to know the mechanism of how the virus works. Viruses have their own genomes, in which viral vectors are then used to insert the newly introduced DNA into the target cells or cells or interest. For the case of Type one diabetes, the DNA inserted into the adenovirus would be the DNA that codes for the T-Cells in the body not to attack the insulin cells, so the body can efficiently produce insulin. In the studies performed with adenoviruses, the body had severe immune responses in the organisms because the adenovirus with the DNA that directly affected the insulin cells was causing insulin secretion for long periods of time when insulin only needs to be secreted every so often. The study of interest of this review shows that the scientists who published this paper were interested in introducing the virus containing the DNA for insulin production into an atypical site of the mice, in this case, the liver. The aim of this study was to allow the liver to perform its normal function and simply add another role, which is allowing the body to produce efficient amounts of insulin for the organism. The scientists of this study introduced a low dose of INS-lentivirus into the portal vein of rats with a mild diabetic state and a severe diabetic state, where they also had a control group that did not receive the virus. This led to a fast decrease in blood glucose levels, where these levels stayed constant for the next year (Elsner, M., et al). The above experiment describes people with type 2 diabetes, but the scientists also tested rats with type one diabetes and still yielded the same results. This experiment also takes the amount of INS-lentivirus into consideration. Someone who is bigger in size may need a greater dose of the virus for this to work correctly. The scientists in this study also observed the levels of the other important function of the liver, meaning the results they yielded were normal in all categories. Therefore, this study shows that by inserting the lentivirus that encodes for human insulin into an atypical area of the body, it can efficiently work to keep insulin levels adequate inside the body.

**Discussion**

 The following study is monumental and could potentially change the lives of many people living with diabetes. The scientists in this study introduced the lentivirus into the portal veins of rats, for which the lentivirus was encoded for human insulin. The results of this experiment showed that the rats’ glucose levels were at a normal level, and an appropriate amount of insulin was being made daily. The rats were observed for over a year, and their insulin and glucose levels were still in the normal range. What happens once the virus is injected into the liver is that the virus forms within the hepatocytes and take a similar characteristic as a B-Cell. Because of this, the immune system does not recognize the hepatocyte as a foreign object, and insulin can then be excreted via the liver. The scientists of this study also showed that the other secretion levels of the liver were normal, and that the addition of the lentivirus to the liver did not affect the other processes of the liver. This method of insulin therapy would be especially helpful for people who are prone to have type two diabetes. People with type two diabetes could have received a low dose of the lentivirus, and this would help to keep up with insulin production and take some strain off of the pancreas. As for people with type one diabetes, this might not cure it for good. Most likely, by injecting the lentivirus into someone with type one diabetes, this would help them produce some insulin, but not enough for the body to efficiently lower blood sugars on its own. This may be a simple fix that the scientists may increase the dosage of the lentivirus and enough insulin is produced, but there is also the scare of what will happen if too much lentivirus is introduced. All in all, in today’s world of modern medicine there have been so many advances in the topic of diabetes. Scientists have gotten very close to finding a cure and are only getting closer as the days go on.

Works Cited

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